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(General - Patent Pending)

Docket No.
200-0646

In Re Application Of: **Juliet C. Kraal et al.**

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
09/630,918	**August 2, 2000**	**T. Stevens**	**33481**	**2123**	**7908**

Title: **SYSTEM AND METHOD OF SUBJECTIVE EVALUATION OF A VEHICLE DESIGN WITHIN A VIRTUAL ENVIRONMENT USING A VIRTUAL REALITY**

COMMISSIONER FOR PATENTS:

Transmitted herewith is:

Amended Appeal Brief (in triplicate), and return postcard.

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Dated: **September 8, 2006**

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PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Art Unit:	2123	)	
		)	
Examiner:	T. Stevens	)	
		)	
Applicant(s):	Juliet C. Kraal et al.	)	**AMENDED APPEAL BRIEF**
		)	
Serial No.:	09/630,918	)	
		)	
Filing Date:	August 2, 2000	)	
		)	
For:	SYSTEM AND METHOD OF SUBJECTIVE EVALUATION OF A VEHICLE DESIGN WITHIN A VIRTUAL ENVIRONMENT USING A VIRTUAL REALITY	)	

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Sir:

This Amended Appeal Brief is in response to the Notification of Non-Compliant Appeal Brief under 37 C.F.R. 41.37 dated August 9, 2006. Although Applicants disagree with the Notification, this Amended Appeal Brief is being submitted in accordance with the Notice of Appeal filed on May 2, 2005. Applicants have appealed the Final Rejection dated January 4, 2005 and submit this Amended Appeal Brief in support of that appeal.

REAL PARTY IN INTEREST

The real party in interest is the Assignee, Ford Global Technologies, Inc.

CERTIFICATE OF MAILING: (37 C.F.R. 1.8) I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the U.S. Postal Service with sufficient postage as First Class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450 on September 8, 2006, by Daniel H. Bliss

RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences regarding the present application.

STATUS OF CLAIMS

Claims 1 through 6 have been rejected.

Claim 7 has been canceled.

Claims 8 through 20 have been rejected.

Claims 1 through 6 and 8 through 20 are being appealed.

STATUS OF AMENDMENTS

An Amendment Under 37 C.F.R. 1.116 was filed on April 4, 2005 in response to the Final Office Action dated January 4, 2005. An Advisory Action dated April 27, 2005 was issued and indicated that the Amendment under 37 C.F.R. 1.116 would be entered upon filing an appeal. A Notice of Appeal, along with the requisite fee, was filed on May 2, 2005. The Appeal Brief, along with the requisite fee, is submitted herewith.

SUMMARY OF THE CLAIMED SUBJECT MATTER

Independent Claim 1

The claimed subject matter of independent claim 1 is directed to a system for subjective evaluation of a vehicle design within a virtual environment using virtual reality including a scaleable physical property representative of the vehicle design. [Referring to FIG. 1, one embodiment of a system 10, according to the present invention, for subjective evaluation

of a vehicle design by immersing a digital occupant within a virtual environment is illustrated. The system 10 includes an adjustable physical property 12 or prop that simulates the vehicle design being evaluated. In this example, the adjustable prop 12 includes a seat 14, a floor 16, a foot control 18, and a steering wheel 20.] (FIG. 1; Specification, page 8, line 22 through page 9, line 2 and page 9, lines 7 through 11).

The physical property is adjusted according to a scale ratio for an evaluator of the vehicle design. The scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of a target population. [The system 10 also includes a physical human or evaluator 32. In this example, the evaluator 32 is seated in the adjustable prop 12 while participating in a study to be described. The evaluator 32 can perform the study as themself, or scaled to represent a different member of a target population, in a manner to be described.] (FIG. 1; Specification, page 10, line 18 through page 11, line 2).

The system also includes a computer system for digitally creating a virtual environment having a virtual human immersed within the virtual environment, wherein the virtual environment includes the vehicle design and the virtual human virtually represents a scaled evaluator. [The system 10 includes a computer system 46 to implement a method, to be described, of subjective evaluation of a vehicle design using virtual reality within a virtual environment 42. The computer system 46 includes a processor 48 having a memory 48a to process information relevant to the evaluation of the vehicle design. The computer system 46 includes a display device 50, such as a video terminal, to display information regarding the evaluation.] (FIG. 1; Specification, page 13, lines 7 through 16).

The system further includes a motion capture system for sensing a motion of the evaluator and communicating the sensed motion of the evaluator to the computer system, so that the motion of the evaluator controls the motion of the virtual human in the virtual environment.

[The system 10 includes a motion capture system 34 strategically positioned on the evaluator 32 to sense the movement of the evaluator 32. Motion capture is also used to operate a virtual human 36 in real time. The motion capture system 34 further includes an instrumented glove 44, as is known in the art, that captures the motion of the evaluator's hand. An example of an instrumental glove 44 is Cybergloves by Virtual Technologies, Inc. The instrumented glove 44 is operatively in communication with the computer system 46, in a manner to be described.] (FIG. 1; Specification, page 11, lines 3 through 7 and page 12, lines 10 through 16).

The system still further includes a virtual reality display mechanism operatively communicating with the computer system, for providing the evaluator a view of the virtual environment while evaluating the vehicle design. [The system 10 also includes a virtual reality display system 40, such as a head mounted display mechanism, known in the art. The virtual reality display mechanism 40 is worn by the evaluator 32, and allows the evaluator 32 to "see" a virtual environment 42 through the eyes of the virtual human 36. An example of a virtual reality display mechanism 40 is PUGO by Kaiser Electro Optics. The virtual reality display mechanism 40 is in communication with the computer system 46, and provides the evaluator 32 a view through the virtual human's eyes, or a first person view of the virtual environment 42.] (FIG. 1; Specification, page 12, line 18 through page 13, line 6).

Independent claim 8

The claimed subject matter of independent claim 8 is directed to a method of subjective evaluation of a vehicle design within a virtual environment using virtual reality. [Referring to FIG. 2, a method 70 according to the present invention, of subjective evaluation of

a vehicle design using virtual reality is illustrated.] (FIG. 2; Specification, page 16, lines 3 through 6).

The method includes the steps of preparing an evaluator of a vehicle design for immersion as a virtual human in the virtual environment, wherein the virtual environment is created within a computer system and includes the vehicle design. [The evaluator 32 immersed in a virtual environment expects the same visual feedback from the virtual environment as in the physical environment. Therefore, the method 70 provides for personal immersion of the evaluator 32 into a virtual environment 42 that includes a full-body, real time dynamic digital representation of the individual being immersed. In block 105, the design team 64 prepares a subjective evaluation of the vehicle design, including criteria for performing the evaluation. It should be appreciated that the subjective evaluation may be in the form of a questionnaire for an evaluator 32 that is administered while the evaluator 32 is immersed in the virtual environment 42.] (FIG. 2; Specification, page 16, lines 6 through 13 and 15 through 21).

The method also includes the steps of determining a scale ratio and range of a target population for the evaluator, wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of the target population. [In block 115, the design team 64 determines a scale ratio and range of a target population represented in the evaluation, to ensure that the prop 12 has sufficient adjustability. Preferably, the target population represents a specific group of consumers within a particular population. It should be appreciated that a predetermined anthropometric dimension for the target population represented in the evaluation is known, and a maximum and minimum scale ratio and range is established for the target population. For example, the design team 64 may determine key anthropometric dimensions for a vision study, including seated eye height. The design team 64 then determines a target population to study, such as small females 5'4" tall. Then, using the

available group of evaluators 32, and anthropometric dimensions, the max/min scale ratio is established to ensure sufficient adjustability in the prop. 12.] (FIG. 2; Specification, page 17, line 19 through page 18, line 12).

The method includes the steps of preparing an adjustable property using the vehicle design and the scale ratio and growing the virtual human within the virtual environment to virtually represent a scaled evaluator. [In block 120, the prop 12 is adjusted to be representative of the same dimensional relationships as the digital vehicle design for the evaluation. For example, the prop's seat 14 and steering wheel 20 have the same geometric relationship as the digital vehicle. The prop 12 is also checked to determine if there is sufficient range to adjust the prop 12 based on the maximum and minimum scale ratio of the target population, for a scaled study. In block 147, the methodology creates or "grows" the virtual human 36 based on the scale ratio and the anthropometric dimensions of the evaluator 32. The virtual human 36 is grown by creating a virtual human 36 the same size as the evaluator 32.] (FIG. 2; Specification, page 18, lines 14 through 22 and page 22, lines 1 through 5).

The method further includes the steps of aligning the virtual human in the virtual environment with the evaluator and the property, performing the evaluation of the vehicle design by the evaluator, and using the evaluation of the vehicle design in the design of the vehicle. [In block 150, the methodology registers the virtual environment 42 to the physical environment including the prop 12, the virtual human 36 to the evaluator 32 and the virtual human 36 in the virtual environment 42. For example, to align the virtual and physical environments, three repeatable markers are located in each environment. The position and orientation of these markers are aligned to register the environments. In block 160, the evaluation is performed by the user 54, design team 64 and evaluator 32. An example of an evaluation is a visibility study that evaluates various pillar 68 design alternatives for the digital vehicle to determine which trim

design would yield optimum exterior visibility. In block 185, the study is made available to the design team 64 for further review and analysis. For example, the design team 64 may publish the results of the study, including results of the questionnaire and the recorded motions, for use by others. The design team 64 may also recommend a change to the vehicle design based on the results of the study.] (FIG. 2; Specification, page 22, lines 12 through 20, page 24, lines 3 through 8, and page 27, lines 7 through 14).

Independent claim 15

The claimed subject matter of independent claim 15 is directed to a method of subjective evaluation of a vehicle design within a virtual environment using virtual reality. [Referring to FIG. 2, a method 70 according to the present invention, of subjective evaluation of a vehicle design using virtual reality is illustrated.] (FIG. 2; Specification, page 16, lines 3 through 6).

The method includes the steps of preparing an adjustable property to represent the vehicle design and measuring the evaluator. [In block 120, the prop 12 is adjusted to be representative of the same dimensional relationships as the digital vehicle design for the evaluation. For example, the prop's seat 14 and steering wheel 20 have the same geometric relationship as the digital vehicle. The prop 12 is also checked to determine if there is sufficient range to adjust the prop 12 based on the maximum and minimum scale ratio of the target population, for a scaled study. The methodology advances to block 125.] (FIG. 2; Specification, page 18, lines 14 through 22).

The method also includes the steps of positioning a full-body motion capture system on an evaluator for sensing a motion of the evaluator and communicating the sensed

motion of the evaluator to a computer system, so that the motion of the evaluator controls the motion of the virtual human in the virtual environment. [The system 10 includes a motion capture system 34 strategically positioned on the evaluator 32 to sense the movement of the evaluator 32. Motion capture is also used to operate a virtual human 36 in real time. The motion capture system 34 further includes an instrumented glove 44, as is known in the art, that captures the motion of the evaluator's hand. An example of an instrumental glove 44 is Cybergloves by Virtual Technologies, Inc. The instrumented glove 44 is operatively in communication with the computer system 46, in a manner to be described.] (FIG. 1; Specification, page 11, lines 3 through 7 and page 12, lines 10 through 16).

The method includes the steps of providing the evaluator with a virtual reality display mechanism operatively communicating with the computer system, for providing the evaluator a view of the virtual environment while evaluating the vehicle design. [The system 10 also includes a virtual reality display system 40, such as a head mounted display mechanism, known in the art. The virtual reality display mechanism 40 is worn by the evaluator 32, and allows the evaluator 32 to "see" a virtual environment 42 through the eyes of the virtual human 36. An example of a virtual reality display mechanism 40 is PUGO by Kaiser Electro Optics. The virtual reality display mechanism 40 is in communication with the computer system 46, and provides the evaluator 32 a view through the virtual human's eyes, or a first person view of the virtual environment 42.] (FIG. 1; Specification, page 12, line 18 through page 13, line 6).

The method also includes the steps of determining a scale ratio and range of a target population for the evaluator wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of the target population. [In block 115, the design team 64 determines a scale ratio and range of a target population represented in the evaluation, to ensure that the prop 12 has sufficient adjustability. Preferably,

the target population represents a specific group of consumers within a particular population. It should be appreciated that a predetermined anthropometric dimension for the target population represented in the evaluation is known, and a maximum and minimum scale ratio and range is established for the target population. For example, the design team 64 may determine key anthropometric dimensions for a vision study, including seated eye height. The design team 64 then determines a target population to study, such as small females 5'4" tall. Then, using the available group of evaluators 32, and anthropometric dimensions, the max/min scale ratio is established to ensure sufficient adjustability in the prop. 12.] (FIG. 2; Specification, page 17, line 19 through page 18, line 12).

The method includes the steps of adjusting the property using the scale ratio for the evaluator and growing the virtual human in the virtual environment using the measurements of the evaluator and the scale ratio to virtually represent a scaled evaluator. [In block 120, the prop 12 is adjusted to be representative of the same dimensional relationships as the digital vehicle design for the evaluation. For example, the prop's seat 14 and steering wheel 20 have the same geometric relationship as the digital vehicle. The prop 12 is also checked to determine if there is sufficient range to adjust the prop 12 based on the maximum and minimum scale ratio of the target population, for a scaled study. In block 147, the methodology creates or "grows" the virtual human 36 based on the scale ratio and the anthropometric dimensions of the evaluator 32. The virtual human 36 is grown by creating a virtual human 36 the same size as the evaluator 32.] (FIG. 2; Specification, page 18, lines 14 through 22 and page 22, lines 1 through 5).

The method further includes the steps of aligning the virtual human in the virtual environment to the evaluator and the property, performing the evaluation of the vehicle design by the evaluator, and using the evaluation of the vehicle design in the design of the vehicle. [In block 150, the methodology registers the virtual environment 42 to the physical environment

including the prop 12, the virtual human 36 to the evaluator 32 and the virtual human 36 in the virtual environment 42. For example, to align the virtual and physical environments, three repeatable markers are located in each environment. The position and orientation of these markers are aligned to register the environments. In block 160, the evaluation is performed by the user 54, design team 64 and evaluator 32. An example of an evaluation is a visibility study that evaluates various pillar 68 design alternatives for the digital vehicle to determine which trim design would yield optimum exterior visibility. In block 185, the study is made available to the design team 64 for further review and analysis. For example, the design team 64 may publish the results of the study, including results of the questionnaire and the recorded motions, for use by others. The design team 64 may also recommend a change to the vehicle design based on the results of the study.] (FIG. 2; Specification, page 22, lines 12 through 20, page 24, lines 3 through 8, and page 27, lines 7 through 14).

GROUND OF REJECTION TO BE REVIEWED ON APPEAL

The ground of rejection to be reviewed on appeal is whether the claimed invention of claims 1 through 6 and 8 through 20 is obvious and unpatentable under 35 U.S.C. § 103 over Nayar (DENEB/ERGO-A Simulation-based Human Factors Tool (1995)) in view of Purschke (Virtual Reality-New Methods for Improving and Accelerating the Development Process in Vehicle Styling and Designing (1998)).

ARGUMENT

Claims Not Obvious or Unpatentable Under 35 U.S.C. § 103

As to patentability, 35 U.S.C. § 103 provides that a patent may not be obtained:

> If the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Id.

The United States Supreme Court interpreted the standard for 35 U.S.C. § 103 in Graham v. John Deere, 383 U.S. 1, 148 U.S.P.Q. 459 (1966). In Graham, the Court stated that under 35 U.S.C. § 103:

> The scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or non-obviousness of the subject matter is determined. 148 U.S.P.Q. at 467.

Using the standard set forth in Graham, the scope and content of the prior art relied upon by the Examiner will be determined.

As to the primary reference applied by the Examiner, the publication "A Simulation-based Human Factors Tool" to Nayar discloses that Deneb/ERGO includes a fully-functional 3D CAD system. This allows the user to either create desired geometry rapidly or use the CAD data translators such as IGES, Pro/ENGINEER, Unigraphics, DXF, STEP, CATIA and VDA to import existing geometry. Data reduction facilities are provided to simplify or modify geometry to enhance graphics performance. Furthermore, existing geometry can be scaled and

stored on the hard disk to build libraries of tools/parts that are commonly used in the working environment. A teaching process is done through a dedicated human motion programming interface. In this paradigm, the user teaches the worker motion sequences. These utilities also facilitate teaching tasks in a parametric way so that the same motion sequences can be used to test the desired range of population.

As to the secondary reference applied by the Examiner, the publication "Virtual Reality-New Methods for Improving and Accelerating the Development Process in Vehicle Styling and Design" to Purschke et al. discloses the use of virtual reality techniques during the car development process. As input devices, a CyberGlove is used for navigating in the virtual environment and for gesture recognition.

Claims 1 through 6

In contradistinction, claim 1 claims the present invention claimed as a system for subjective evaluation of a vehicle design within a virtual environment using virtual reality including a scaleable physical property representative of the vehicle design. The physical property is adjusted according to a scale ratio for an evaluator of the vehicle design. The scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of a target population. The system also includes a computer system for digitally creating a virtual environment having a virtual human immersed within the virtual environment, wherein the virtual environment includes the vehicle design and the virtual human virtually represents a scaled evaluator. The system includes a motion capture system for sensing a motion of the evaluator and communicating the sensed motion of the evaluator to the computer system, so that the motion of the evaluator controls the motion of the virtual human in the virtual

environment. The system further includes a virtual reality display mechanism operatively communicating with the computer system, for providing the evaluator a view of the virtual environment while evaluating the vehicle design.

As to the differences between the prior art and the claims at issue, Nayar merely discloses a simulation-based human factors tool in which a fully-functional 3D CAD system allows existing geometry to be scaled and stored on a hard disk to build libraries of tools/parts that are commonly used in a working environment and a dedicated human motion programming interface that teaches the worker motion sequences so that the same motion sequences can be used to test a desired range of population. Nayar lacks a scaleable physical property representative of a vehicle design, wherein the physical property is adjusted according to a scale ratio for an evaluator of the vehicle design. In Nayar, while existing geometry can be scaled and stored to build libraries, it does not mention that a physical property of a vehicle design is adjusted according to a scale ratio for an evaluator of the vehicle design. Nayar also lacks a scale ratio that is a ratio between a predetermined dimension of an evaluator and a predetermined dimension of a member of a target population. In Nayar, while worker motion sequences can be used to test a desired range of population, it does not mention that a scale ratio is a ratio between a predetermined dimension of an evaluator and a predetermined dimension of a member of a target population.

Purschke et al. merely discloses the use of virtual reality techniques during the car development process in which a CyberGlove is used for navigating in the virtual environment and for gesture recognition. Purschke et al. lacks a scaleable physical property representative of the vehicle design, wherein the physical property is adjusted according to a scale ratio for an evaluator of the vehicle design and the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of a target population. In Purschke

et al., there is no mention of a physical property being adjusted according to a scale ratio for an evaluator or a scale ratio is a ratio between a predetermined dimension of an evaluator and a predetermined dimension of a member of a target population. As such, there is no suggestion or motivation in the art to combine Nayar and Purschke et al. together.

As to the level of ordinary skill in the pertinent art, Nayar merely discloses a fully-functional 3D CAD system that allows existing geometry to be scaled and stored on a hard disk to build libraries of tools/parts that are commonly used in a working environment. Purschke et al. merely discloses a CyberGlove used for navigating in a virtual environment. However, there is absolutely no teaching of a level of skill in the vehicle design art that a system for subjective evaluation of a vehicle design within a virtual environment using virtual reality includes a scaleable physical property representative of the vehicle design, wherein the physical property is adjusted according to a scale ratio for an evaluator of the vehicle design and the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of a target population. The Examiner may not, because he doubts that the invention is patentable, resort to speculation, unfounded assumptions or hindsight reconstruction to supply deficiencies in the factual basis. See In re Warner, 379 F. 2d 1011, 154 U.S.P.Q. 173 (CCPA 1967).

While Nayar teaches a simulation-based human factors tool in which a fully-functional 3D CAD system allows existing geometry to be scaled, Nayar does not teach or suggest a vehicle design within a virtual environment including a scaleable physical property representative of the vehicle design, wherein the physical property is adjusted according to a scale ratio for an evaluator of the vehicle design and the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of a target population. Contrary to the Examiner's opinion, Nayar has nothing to do with vehicle

design and therefore cannot disclose a scalable physical property representative of a vehicle design. Further, Purschke et al. does not make up for these deficiencies. Purschke et al. teaches the use of a CyberGlove for navigating in a virtual environment. Purschke et al. does not teach a scaleable physical property representative of a vehicle design, wherein the physical property is adjusted according to a scale ratio for an evaluator of the vehicle design and the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of a target population. In this instance, the Examiner has adduced no factual basis to support his position that it would have been obvious to one of ordinary skill in the art to use Purschke et al. to modify Nayar to have a scalable virtual human to adjust specific car interior features towards a specific market demographic. The Examiner's stated conclusion of obviousness is based on speculation, unfounded assumptions or hindsight reconstruction to supply deficiencies in the factual basis.

The references, if combinable, fail to teach or suggest the combination of a system for subjective evaluation of a vehicle design within a virtual environment using virtual reality including a scaleable physical property representative of the vehicle design, wherein the physical property is adjusted according to a scale ratio for an evaluator of the vehicle design and the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of a target population, a computer system for digitally creating a virtual environment having a virtual human immersed within the virtual environment, wherein the virtual environment includes the vehicle design and the virtual human virtually represents a scaled evaluator, a motion capture system for sensing a motion of the evaluator and communicating the sensed motion of the evaluator to the computer system, so that the motion of the evaluator controls the motion of the virtual human in the virtual environment, and a virtual reality display mechanism operatively communicating with the computer system, for providing

the evaluator a view of the virtual environment while evaluating the vehicle design as claimed by Applicants.

Further, the CAFC has held that "[t]he mere fact that prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification". In re Gordon, 733 F.2d 900, 902, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984). The Examiner has failed to show how the prior art suggested the desirability of modification to achieve Applicants' invention. Thus, the Examiner has failed to establish a case of prima facie obviousness.

The present invention sets forth a unique and non-obvious combination of a system for subjective evaluation of a vehicle design within a virtual environment using virtual reality including a scaleable physical property representative of the vehicle design, wherein the physical property is adjusted according to a scale ratio for an evaluator of the vehicle design and the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of a target population. Advantageously, the system can be utilized to evaluate a vehicle design based on a consumer's perception of ergonomic factors such as visibility, reach and clearance, early in the design process.

Against this background, it is submitted that the present invention of claims 1 through 6 is not obvious in view of a proposed combination of Nayar and Purschke et al. The references fail to teach or suggest the combination of the system for subjective evaluation of a vehicle design within a virtual environment using virtual reality of claims 1 through 6. Therefore, it is respectfully submitted that claims 1 through 6 are not obvious and are allowable over the rejection under 35 U.S.C. § 103.

Claims 8 through 14

As to claim 8, claim 8 claims the present invention as a method of subjective evaluation of a vehicle design within a virtual environment using virtual reality. The method includes the steps of preparing an evaluator of a vehicle design for immersion as a virtual human in the virtual environment, wherein the virtual environment is created within a computer system and includes the vehicle design. The method also includes the steps of determining a scale ratio and range of a target population for the evaluator, wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of the target population. The method includes the steps of preparing an adjustable property using the vehicle design and the scale ratio and growing the virtual human within the virtual environment to virtually represent a scaled evaluator. The method further includes the steps of aligning the virtual human in the virtual environment with the evaluator and the property, performing the evaluation of the vehicle design by the evaluator, and using the evaluation of the vehicle design in the design of the vehicle.

As to the differences between the prior art and the claims at issue, Nayar <u>merely</u> discloses a simulation-based human factors tool in which a fully-functional 3D CAD system allows existing geometry to be scaled and stored on a hard disk to build libraries of tools/parts that are commonly used in a working environment and a dedicated human motion programming interface that teaches the worker motion sequences so that the same motion sequences can be used to test a desired range of population. Nayar lacks determining a scale ratio and range of a target population for an evaluator. In Nayar, while existing geometry can be scaled and stored to build libraries, it does <u>not</u> mention determining a scale ratio and range of population <u>for an evaluator</u>. Nayar also lacks a scale ratio that is a ratio <u>between</u> a predetermined dimension of an

evaluator and a predetermined dimension of a member of a target population. In Nayar, while worker motion sequences can be used to test a desired range of population, it does not mention that a scale ratio is a ratio between a predetermined dimension of an evaluator and a predetermined dimension of a member of a target population.

Purschke et al. merely discloses the use of virtual reality techniques during the car development process in which a CyberGlove is used for navigating in the virtual environment and for gesture recognition. Purschke et al. lacks determining a scale ratio and range of a target population for an evaluator, wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of the target population. In Purschke et al., there is no mention of determining a scale ratio and range of a target population for an evaluator or a scale ratio that is a ratio between a predetermined dimension of an evaluator and a predetermined dimension of a member of a target population. As such, there is no suggestion or motivation in the art to combine Nayar and Purschke et al. together.

There is absolutely no teaching of a level of skill in the vehicle design art that a method for subjective evaluation of a vehicle design within a virtual environment using virtual reality includes the steps of determining a scale ratio and range of a target population for an evaluator, wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of the target population. The Examiner may not, because he doubts that the invention is patentable, resort to speculation, unfounded assumptions or hindsight reconstruction to supply deficiencies in the factual basis. See In re Warner, 379 F. 2d 1011, 154 U.S.P.Q. 173 (C.C.P.A. 1967).

While Nayar teaches a simulation-based human factors tool in which a fully-functional 3D CAD system allows existing geometry to be scaled and that worker motion sequences can be used to test a desired range of population, Nayar does not teach or suggest a

method for subjective evaluation of a vehicle design within a virtual environment including the steps of determining a scale ratio and range of a target population for an evaluator, and a scale ratio that is a ratio between a predetermined dimension of an evaluator and a predetermined dimension of a member of a target population. Contrary to the Examiner's opinion, Nayar has nothing to do with vehicle design and therefore cannot disclose a scalable physical property representative of a vehicle design. Purschke et al. does not make up for these deficiencies. Purschke et al. teaches the use of a CyberGlove is used for navigating in a virtual environment. Purschke et al. does not teach determining a scale ratio and range of a target population for an evaluator, wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of the target population. Thus, none of the references teaches a level of skill in the art of vehicle design that a method can be constructed by determining a scale ratio and range of a target population for an evaluator, and a scale ratio that is a ratio between a predetermined dimension of an evaluator and a predetermined dimension of a member of a target population.

Even if the reference could be combined, they do not teach a level of skill in the art of vehicle design of determining a scale ratio and range of a target population for an evaluator, wherein a scale ratio is a ratio between a predetermined dimension of an evaluator and a predetermined dimension of a member of a target population . Applicants are not attacking the references individually, but are clearly pointing out that each reference is deficient and, if combined (although Applicants maintain that they are not combinable), the combination is deficient. The present invention sets forth a unique and non-obvious combination of a system for subjective evaluation of a vehicle design within a virtual environment using virtual reality that scales the size of the evaluator in the virtual vehicle environment, so the evaluator can understand how another member of the target population perceives the vehicle design.

The references, if combinable, fail to teach or suggest the combination of a method for subjective evaluation of a vehicle design within a virtual environment using virtual reality including the steps of preparing an evaluator of a vehicle design for immersion as a virtual human in the virtual environment, determining a scale ratio and range of a target population for the evaluator, wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of the target population, preparing an adjustable property using the vehicle design and the scale ratio, growing the virtual human within the virtual environment to virtually represent a scaled evaluator, aligning the virtual human in the virtual environment with the evaluator and the property, performing the evaluation of the vehicle design by the evaluator, and using the evaluation of the vehicle design in the design of the vehicle as claimed by Applicants.

Against this background, it is submitted that the present invention of claims 8 through 14 is not obvious in view of a proposed combination of Nayar and Purschke et al. The references fail to teach or suggest the combination of the method for subjective evaluation of a vehicle design within a virtual environment using virtual reality of claims 8 through 14. Therefore, it is respectfully submitted that claims 8 through 14 are not obvious and are allowable over the rejection under 35 U.S.C. § 103.

Claims 15 through 20

As to claim 15, claim 15 claims a method of subjective evaluation of a vehicle design within a virtual environment using virtual reality. The method includes the steps of preparing an adjustable property to represent the vehicle design and measuring the evaluator. The method also includes the steps of positioning a full-body motion capture system on an

evaluator for sensing a motion of the evaluator and communicating the sensed motion of the evaluator to a computer system, so that the motion of the evaluator controls the motion of the virtual human in the virtual environment. The method includes the steps of providing the evaluator with a virtual reality display mechanism operatively communicating with the computer system, for providing the evaluator a view of the virtual environment while evaluating the vehicle design. The method also includes the steps of determining a scale ratio and range of a target population for the evaluator wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of the target population. The method includes the steps of adjusting the property using the scale ratio for the evaluator and growing the virtual human in the virtual environment using the measurements of the evaluator and the scale ratio to virtually represent a scaled evaluator. The method further includes the steps of aligning the virtual human in the virtual environment to the evaluator and the property, performing the evaluation of the vehicle design by the evaluator, and using the evaluation of the vehicle design in the design of the vehicle.

As to the differences between the prior art and the claims at issue, Nayar <u>merely</u> discloses a simulation-based human factors tool in which a fully-functional 3D CAD system allows existing geometry to be scaled and stored on a hard disk to build libraries of tools/parts that are commonly used in a working environment and a dedicated human motion programming interface that teaches the worker motion sequences so that the same motion sequences can be used to test a desired range of population. Nayar lacks determining a scale ratio and range of a target population for an evaluator. In Nayar, while existing geometry can be scaled and stored to build libraries, it does <u>not</u> mention determining a scale ratio and range of population <u>for an evaluator</u>. Nayar also lacks a scale ratio that is a ratio <u>between</u> a predetermined dimension of an evaluator and a predetermined dimension of a member of a target population. In Nayar, while

worker motion sequences can be used to test a desired range of population, it does not mention that a scale ratio is a ratio between a predetermined dimension of an evaluator and a predetermined dimension of a member of a target population. Further, Nayar lacks adjusting the property using the scale ratio for the evaluator and growing the virtual human in the virtual environment using the measurements of the evaluator and the scale ratio to virtually represent a scaled evaluator. In Nayar, there is no mention of such feature.

Purschke et al. merely discloses the use of virtual reality techniques during the car development process in which a CyberGlove is used for navigating in the virtual environment and for gesture recognition. Purschke et al. lacks determining a scale ratio and range of a target population for an evaluator, wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of the target population. In Purschke et al., there is no mention of determining a scale ratio and range of a target population for an evaluator or a scale ratio that is a ratio between a predetermined dimension of an evaluator and a predetermined dimension of a member of a target population. Further, Purschke et al. lacks adjusting the property using the scale ratio for the evaluator and growing the virtual human in the virtual environment using the measurements of the evaluator and the scale ratio to virtually represent a scaled evaluator. In Purschke et al., there is no mention of this feature. As such, there is no suggestion or motivation in the art to combine Nayar and Purschke et al. together.

There is absolutely no teaching of a level of skill in the vehicle design art that a method for subjective evaluation of a vehicle design within a virtual environment using virtual reality includes the steps of determining a scale ratio and range of a target population for an evaluator, wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of the target population, adjusting the property using the scale ratio for the evaluator, and growing the virtual human in the virtual environment

using the measurements of the evaluator and the scale ratio to virtually represent a scaled evaluator. The Examiner may not, because he doubts that the invention is patentable, resort to speculation, unfounded assumptions or hindsight reconstruction to supply deficiencies in the factual basis. See In re Warner, 379 F. 2d 1011, 154 U.S.P.Q. 173 (C.C.P.A. 1967).

While Nayar teaches a simulation-based human factors tool in which a fully-functional 3D CAD system allows existing geometry to be scaled and that worker motion sequences can be used to test a desired range of population, Nayar does not teach or suggest that a method for subjective evaluation of a vehicle design within a virtual environment including the steps of determining a scale ratio and range of a target population for an evaluator, wherein a scale ratio that is a ratio between a predetermined dimension of an evaluator and a predetermined dimension of a member of a target population. Contrary to the Examiner's opinion, Nayar has nothing to do with vehicle design and therefore cannot disclose a scalable physical property representative of a vehicle design. Further, Nayar does not teach or suggest adjusting the property using the scale ratio for the evaluator and growing the virtual human in the virtual environment using the measurements of the evaluator and the scale ratio to virtually represent a scaled evaluator. Purschke et al. does not make up for these deficiencies. Purschke et al. teaches the use of a CyberGlove is used for navigating in a virtual environment. Purschke et al. does not teach determining a scale ratio and range of a target population for an evaluator, wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of the target population, or adjusting the property using the scale ratio for the evaluator and growing the virtual human in the virtual environment using the measurements of the evaluator and the scale ratio to virtually represent a scaled evaluator. Thus, none of the references teaches a level of skill in the art of vehicle design that a method can be constructed as determining a scale ratio and range of a target population for an evaluator,

wherein a scale ratio is a ratio <u>between</u> a predetermined dimension of an evaluator and a predetermined dimension of a member of a target population, and adjusting the property using the scale ratio for the evaluator and growing the virtual human in the virtual environment using the measurements of the evaluator and the scale ratio to virtually represent a scaled evaluator.

Even if the reference could be combined, they do <u>not</u> teach a level of skill in the art of vehicle design of determining a scale ratio and range of a target population for an evaluator, wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of the target population, and/or adjusting the property using the scale ratio for the evaluator and growing the virtual human in the virtual environment using the measurements of the evaluator and the scale ratio to virtually represent a scaled evaluator. The references, if combinable, fail to teach or suggest the combination of a method of subjective evaluation of a vehicle design within a virtual environment using virtual reality including the steps of preparing an adjustable property to represent the vehicle design, measuring the evaluator, positioning a full-body motion capture system on an evaluator for sensing a motion of the evaluator, communicating the sensed motion of the evaluator to a computer system, so that the motion of the evaluator controls the motion of the virtual human in the virtual environment, providing the evaluator with a virtual reality display mechanism operatively communicating with the computer system, for providing the evaluator a view of the virtual environment while evaluating the vehicle design, determining a scale ratio and range of a target population for the evaluator wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of the target population, adjusting the property using the scale ratio for the evaluator, growing the virtual human in the virtual environment using the measurements of the evaluator and the scale ratio to virtually represent a scaled evaluator,

aligning the virtual human in the virtual environment to the evaluator and the property, performing the evaluation of the vehicle design by the evaluator, and using the evaluation of the vehicle design in the design of the vehicle as claimed by Applicants.

The present invention sets forth a unique and non-obvious combination of a method of subjective evaluation of a vehicle design within a virtual environment using virtual reality including determining a scale ratio and range of a target population for the evaluator wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of the target population, adjusting the property using the scale ratio for the evaluator, growing the virtual human in the virtual environment using the measurements of the evaluator and the scale ratio to virtually represent a scaled evaluator, aligning the virtual human in the virtual environment to the evaluator and the property, performing the evaluation of the vehicle design by the evaluator. Advantageously, the method scales the size of the evaluator in the virtual vehicle environment, so the evaluator can understand how another member of the target population perceives the vehicle design.

Obviousness under § 103 is a legal conclusion based on factual evidence (<u>In re Fine</u>, 837 F.2d 1071, 1073, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988), and the subjective opinion of the Examiner as to what is or is not obvious, without evidence in support thereof, does not suffice. Since the Examiner has not provided a sufficient factual basis which is supportive of his position (see <u>In re Warner</u>, 379 F.2d 1011, 1017, 154 U.S.P.Q. 173, 178 (C.C.P.A. 1967), <u>cert. Denied</u>, 389 U.S. 1057 (1968)), the rejection of claims 15 through 20 is improper.

Against this background, it is submitted that the present invention of <u>claims 15 through 20 is not obvious</u> in view of a proposed combination of Nayar and Purschke et al. The references fail to teach or suggest the combination of the method of subjective evaluation of a vehicle design within a virtual environment using virtual reality of claims 15 through 20.

Therefore, it is respectfully submitted that claims 15 through 20 are not obvious and are allowable over the rejection under 35 U.S.C. § 103.

CONCLUSION

In conclusion, it is respectfully submitted that the rejection of claims 1 through 6 and 8 through 20 is improper and should be reversed.

Respectfully submitted,

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CLAIMS APPENDIX

The claims on appeal are as follows:

1. A system for subjective evaluation of a vehicle design within a virtual environment using virtual reality comprising:

a scaleable physical property representative of the vehicle design, wherein the physical property is adjusted according to a scale ratio for an evaluator of the vehicle design, wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of a target population;

a computer system for digitally creating a virtual environment having a virtual human immersed within the virtual environment, wherein the virtual environment includes the vehicle design and the virtual human virtually represents a scaled evaluator;

a motion capture system for sensing a motion of the evaluator and communicating the sensed motion of the evaluator to the computer system, so that the motion of the evaluator controls the motion of the virtual human in the virtual environment; and

a virtual reality display mechanism operatively communicating with the computer system, for providing the evaluator a view of the virtual environment while evaluating the vehicle design.

2. The system of claim 1 wherein the motion capture system includes an instrumented glove worn by the evaluator for sensing motion of the evaluator's hand.

3. The system of claim 1 wherein the motion capture system includes magnetic spatial tracking sensors located on the evaluator for sensing motion of the evaluator's full body.

4. The system of claim 1 wherein the virtual reality display mechanism includes a head mounted display mechanism worn by the evaluator for seeing the virtual environment through an eye of the virtual human.

5. The system of claim 1 wherein the computer system includes at least one video terminal displaying a view of the virtual environment as seen through an eye of the virtual human.

6. The system of claim 1 wherein the computer system includes at least one video terminal displaying a third person view of the virtual human immersed within the virtual environment.

8. A method of subjective evaluation of a vehicle design within a virtual environment using virtual reality, said method comprising the steps of:

preparing an evaluator of a vehicle design for immersion as a virtual human in the virtual environment, wherein the virtual environment is created within a computer system and includes the vehicle design;

determining a scale ratio and range of a target population for the evaluator, wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of the target population;

preparing an adjustable property using the vehicle design and the scale ratio;

growing the virtual human within the virtual environment to virtually represent a scaled evaluator;

aligning the virtual human in the virtual environment with the evaluator and the property,

performing the evaluation of the vehicle design by the evaluator; and

using the evaluation of the vehicle design in the design of the vehicle.

9. A method as set forth in claim 8 wherein said step of preparing an evaluator includes the step of measuring an anthropometric dimension of the evaluator.

10. A method as set forth in claim 8 wherein said step of preparing an evaluator includes the step of positioning a motion capture system on the evaluator for sensing a motion of the evaluator and communicating the sensed motion of the evaluator to the computer system, so that the motion of the evaluator controls the motion of the virtual human in the virtual environment.

11. A method as set forth in claim 8 wherein said step of preparing an evaluator includes providing the evaluator with a virtual reality display mechanism operatively communicating with the computer system, for providing the evaluator a view of the virtual environment while evaluating the vehicle design.

12. A method as set forth in claim 8 wherein the step of preparing an adjustable property includes the step of determining a scale ratio range for a member of a target

population represented in the evaluation and using the scale ratio range to determine adjustability of the property.

13. A method as set forth in claim 8 including the step of determining whether to perform a new evaluation and performing a new evaluation if determined to perform a new evaluation.

14. A method as set forth in claim 8 wherein said step of growing the virtual human includes the steps of:

assuming an initial posture by the evaluator;

digitally establishing locations of motion capture sensors positioned on the evaluator in the initial posture using a computer system;

creating a virtual human digitally to represent the evaluator using the digital motion capture sensor locations for the virtual human, the evaluator's measurements and the scale ratio;

aligning the virtual human with the evaluator, wherein the motion capture sensor locations on the virtual human are aligned with the motion capture sensor locations on the evaluator; and

checking that the motion of the virtual human mirrors the motion of the evaluator.

15. A method of subjective evaluation of a vehicle design within a virtual environment using virtual reality, said method comprising the steps of:

preparing an adjustable property to represent the vehicle design;

measuring the evaluator;

positioning a full-body motion capture system on an evaluator for sensing a motion of the evaluator and communicating the sensed motion of the evaluator to a computer system, so that the motion of the evaluator controls the motion of the virtual human in the virtual environment;

providing the evaluator with a virtual reality display mechanism operatively communicating with the computer system, for providing the evaluator a view of the virtual environment while evaluating the vehicle design

determining a scale ratio and range of a target population for the evaluator wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of the target population;

adjusting the property using the scale ratio for the evaluator;

growing the virtual human in the virtual environment using the measurements of the evaluator and the scale ratio to virtually represent a scaled evaluator;

aligning the virtual human in the virtual environment to the evaluator and the property;

performing the evaluation of the vehicle design by the evaluator; and

using the evaluation of the vehicle design in the design of the vehicle.

16. A method as set forth in claim 15, including the step of determining whether to perform a new evaluation and performing a new evaluation if determined to perform a new evaluation.

17. A method as set forth in claim 16 including the step of determining whether to use a new evaluator and using a new evaluator if determined to use a new evaluator.

18. A method as set forth in claim 17 including the step of determining whether to revise the scale ratio if determined not to use a new evaluator and revising the scale ratio if determined to revise the scale ratio.

19. A method as set forth in claim 15 wherein said step of growing the virtual human includes the steps of:

assuming an initial posture by the evaluator;

digitally establishing locations of motion capture sensors positioned on the evaluator in the initial posture using a computer system;

creating a virtual human digitally using the motion capture sensor locations for the virtual human and the scaled measurements of the evaluator;

aligning the virtual human with the evaluator, wherein the motion capture sensor locations on the virtual human are aligned with the motion capture sensor locations on the evaluator; and

checking that the motion of the virtual human mirrors the motion of the evaluator.

20. A method as set forth in claim 15, including the step of determining a scale ratio range for a member of a target population represented in the evaluation and using the scale ratio range to determine adjustability of the property.

EVIDENCE APPENDIX

None

RELATED PROCEEDINGS APPENDIX

None